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Electric Scooter Injuries and Hospital Admissions in the United States, 2014-2018.

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Letters

RESEARCH LETTER

Electric Scooter Injuries and Hospital Admissions in the United States, 2014-2018

Electric scooters (e-scooters) are a novel, rapid, and convenient mode of transportation with increasing accessibility across the United States.[1] E-scooter use may decrease traffic congestion and increase public transit use.[2] Expansion of e-scooters in dense, high-traffic urban areas will affect rider injury in unknown ways and lead to new policies already implemented by some major cities.[3] With the influx of e-scooter availability in urban areas, particularly in the past year,[3] we sought to investigate trends of injury and hospital admission.

Methods | The National Electronic Injury Surveillance System (NEISS) provides national estimates of injuries that present to emergency departments across the United States (https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data). We queried

Table 1. Trends in Number and Type of Electric Scooter Injuries and Hospital Admissions from 2014 to 2018

Trend	2014	2015	2016	2017	2018	% Change[a]	*P* Value[b]
Injury cases, No. (95% CI)[c]	4582 (3329 to 5835)	5661 (3847 to 7476)	6203 (4116 to 8290)	8016 (4821 to 11 210)	14 651 (7166 to 22 136)	NA	NA
Age-adjusted incidence[d]	6 (3 to 9)	7 (4 to 11)	8 (4 to 12)	10 (4 to 16)	19 (6 to 32)	222	.01
Hospital admissions, No. (95% CI)[c]	313 (0 to 648)	358 (48 to 669)	531 (182 to 880)	715 (151 to 1279)	1374 (552 to 2196)	NA	NA
Age-adjusted incidence[d]	0.4 (0 to 1.0)	0.4 (0 to 1.0)	0.7 (0 to 1.5)	0.9 (0 to 2.0)	1.8 (0 to 3.6)	365	.39
Type of injury[e]							
Head[f]							
No. (95% CI)	1370 (830 to 1910)	1320 (703 to 1938)	1864 (870 to 2858)	1848 (913 to 2783)	4658 (1815 to 7501)	NA	.46
% (95% CI)	30 (21 to 40)	23 (14 to 35)	30 (19 to 44)	23 (17 to 30)	32 (26 to 38)	6	
Torso[g]							
No. (95% CI)	394 (89 to 699)	610 (124 to 1097)	760 (292 to 1227)	511 (35 to 986)	1418 (636 to 2199)	NA	.75
% (95% CI)	9 (4 to 17)	11 (6 to 19)	12 (7 to 20)	6 (3 to 13)	10 (6 to 15)	13	
Extremity							
Upper							
No. (95% CI)	1083 (537 to 1629)	2355 (1387 to 3323)	1337 (689 to 1985)	2176 (1140 to 3212)	3747 (1720 to 5775)	NA	.27
% (95% CI)	24 (15 to 36)	42 (32 to 52)	22 (13 to 33)	27 (21 to 34)	26 (21 to 31)	8	
Lower							
No. (95% CI)	1721 (1012 to 2430)	1375 (633 to 2118)	2104 (1023 to 3186)	3466 (2162 to 4771)	4707 (2369 to 7044)	NA	.67
% (95% CI)	38 (29 to 48)	24 (16 to 36)	34 (24 to 45)	43 (37 to 50)	32 (27 to 37)	-14	
Type of hospital[h]							
Rural							
No. (95% CI)	979 (359 to 1599)	1677 (954 to 2400)	1331 (56 to 2605)	1698 (872 to 2524)	2059 (1128 to 2990)	NA	.12
% (95% CI)	21 (12 to 36)	30 (19 to 44)	21 (9 to 43)	21 (12 to 35)	14 (7 to 26)	-34	
Urban							
No. (95% CI)	3500 (2372 to 4628)	3840 (2129 to 5551)	4719 (3019 to 6419)	6146 (3035 to 9258)	12 200 (4739 to 19 661)	NA	.15
% (95% CI)	76 (63 to 86)	68 (54 to 79)	76 (56 to 89)	77 (63 to 87)	83 (71 to 91)	9	
Children's							
No. (95% CI)	102 (37 to 169)	144 (38 to 250)	153 (57 to 250)	171 (89 to 253)	392 (159 to 624)	NA	.82
% (95% CI)	2 (1 to 4)	3 (1 to 6)	2 (1 to 5)	2 (1 to 4)	3 (1 to 6)	19	

Abbreviations: NA, not applicable; NEISS, National Electronic Injury Surveillance System.

[a] Indicates percentage change from 2014 to 2018 calculated as: [(Value for 2018−Value for 2014)/(Value for 2014)] × 100.

[b] Determined using linear regression (No. vs time).

[c] Counts from NEISS database for all ages.

[d] Age adjustment performed using direct standardization. Incidence displayed as population estimate of injured scooter motorists per 100 000 persons in the US population (95% CI).

[e] Burn injuries excluded.

[f] Includes neck injuries.

[g] Includes pubic region and internal injuries.

[h] Hospital size used as a proxy for hospital type; rural hospitals were compiled from small hospitals and urban from medium, large, and very large inner-city hospitals.

Table 2. Proportion of Electric Scooter Injuries and Hospital Admissions by Age Group From 2014 to 2018

Age Group	2014	2015	2016	2017	2018	% Change[a]	*P* Value[b]
<18 y							
Injuries							
No. (95% CI)	2304 (1354 to 3254)	3404 (2213 to 4595)	3245 (1932 to 4558)	3298 (2188 to 4407)	4843 (2702 to 6984)	NA	.03
% (95% CI)	50 (36 to 64)	60 (45 to 74)	52 (42 to 62)	41 (25 to 60)	33 (17 to 55)	-34	
Hospital admissions							
No. (95% CI)	74 (16 to 133)	21 (0 to 55)	117 (0 to 253)	62 (0 to 135)	335 (0 to 824)	NA	.32
% (95% CI)	24 (6 to 61)	6 (1 to 28)	22 (6 to 57)	9 (3 to 26)	24 (6 to 62)	2	
18-34 y							
Injuries							
No. (95% CI)	582 (0 to 1208)	534 (178 to 890)	1090 (518 to 1662)	2105 (269 to 3941)	5309 (1092 to 9527)	NA	<.001
% (95% CI)	13 (4 to 31)	9 (5 to 16)	18 (11 to 27)	26 (14 to 44)	36 (25 to 50)	185	
Hospital admissions							
No. (95% CI)	30 (0 to 71)	0	94 (0 to 227)	218 (0 to 504)	599 (79 to 1118)	NA	.02
% (95% CI)	10 (2 to 40)	0	18 (5 to 46)	30 (10 to 64)	44 (20 to 70)	354	
35-54 y							
Injuries							
No. (95% CI)	909 (418 to 1399)	709 (218 to 1201)	1047 (445 to 1649)	1115 (244 to 1985)	3152 (202 to 6102)	NA	.53
% (95% CI)	20 (11 to 32)	13 (7 to 21)	17 (11 to 25)	14 (9 to 21)	22 (13 to 34)	8	
Hospital admissions							
No. (95% CI)	45 (0 to 135)	107 (0 to 262)	93 (0 to 279)	230 (0 to 469)	229 (0 to 459)	NA	.98
% (95% CI)	14 (1 to 66)	30 (6 to 72)	18 (3 to 64)	32 (12 to 61)	17 (7 to 36)	16	
>55 y							
Injuries							
No. (95% CI)	787 (285 to 1288)	1014 (352 to 1676)	821 (397 to 1245)	1498 (496 to 2501)	1346 (557 to 2135)	NA	.06
% (95% CI)	17 (9 to 30)	18 (10 to 29)	13 (8 to 20)	19 (10 to 31)	9 (5 to 17)	-46	
Hospital admissions							
No. (95% CI)	163 (0 to 488)	230 (0 to 497)	228 (28 to 427)	205 (0 to 534)	211 (7 to 414)	NA	.64
% (95% CI)	52 (11 to 91)	64 (25 to 91)	43 (20 to 70)	29 (6 to 71)	15 (5 to 37)	-71	

Abbreviation: NA, not applicable.

[a] Indicates percentage change from 2014-2018 calculated as: [(Value for 2018−Value for 2014)/(Value for 2014)] × 100.

[b] Determined using linear regression (No. vs time).

NEISS for injuries related to powered scooters (code 5042) from 2014 to 2018, with keyword *scooter* in the description (n = 1037). We excluded non-e-scooter injuries (n = 49). We used NEISS complex sampling design to obtain US population projections of injuries and hospital admissions. Population estimates from the US Census Bureau (https://www.census.gov/programs-surveys/popest/data/data-sets.html) were used for the direct method of age adjustment. The data source was public, deidentified, and was exempt from the University of California, San Francisco, institutional review board approval. Owing to the use of deidentified data, patient consent was not obtained. We applied linear regression to determine trends of injuries and admissions. We used Stata, version 15 (StataCorp); 2-sided *P* values less than .05 were considered significant.

Results | There was a dramatic increase in injuries and admissions from 2017 to 2018 associated with e-scooter use. During the study period, a weighted total of 39 113 (95% CI, 28 151-50 074) e-scooter injuries occurred in the United States (988 NEISS cases). Age-adjusted e-scooter injury incidence per 100 000 significantly increased by 222%, from 6 (95% CI, 3-9) to 19 (95% CI, 6-32) (*P* = .01). There was an increase in age-adjusted hospital admission by 365%, from 0.4 (95% CI, 0-1.0) to 1.8 (95% CI, 0-3.6) (*P* = .39). Thirty-six percent of those injured across the study period were women. Over the study period, urban hospitals received the highest proportion of patients (78%; 95% CI, 68-85) compared with rural (20%; 95% CI, 13-29) and children's hospitals (2%; 95% CI, 1-4).

While the incidence of injuries increased over the study period, the body region injured was stable. In 2018, 4707 of 14 651 e-scooter injuries involved the head (32%; 95% CI, 26-38). Upper and lower extremity injuries increased from 1083 (95% CI, 537-1629) to 3747 (95% CI, 1720-5775) (*P* = .27) and 1721 (95% CI, 1012-2430) to 4707 (95% CI, 2369-7044) (*P* = .67) (**Table 1**), respectively. The most common injuries during the study period were fractures (27%; 95% CI, 23-31), contusions and abrasions (23%; 95% CI, 20-28), and lacerations (14%; 95% CI, 12-18).

The proportion of injuries among those aged 18 to 34 years increased by 185%, from 582 of 4582 (13%; 95% CI, 4-31) to 5309

of 14 651 (36%; 95% CI, 25-50) (P < .001) (**Table 2**). Admissions among those aged 18 to 34 years also increased by 354%, from 30 of 313 (10%; 95% CI, 2-40) to 599 of 1374 (44%; 95% CI, 20-70) (P = .02). There was also a significant increase in injuries among those younger than 18 years, yet the overall proportion compared with other age groups decreased over the study period by 34%.

Discussion | We report significant increases in e-scooter injuries and admissions between 2014 and 2018, particularly over the last year, with people aged 18 to 34 years becoming the most injured group. The proportion of hospital admissions of people aged 18 to 34 years increased 354%, compared with 2% for people younger than 18 years. Our findings are consistent with a 2019 case series from 2 urban trauma centers.[4] Despite being unable to account for ridership exposure, the nearly doubling of incident e-scooter trauma calls for improved rider safety measures and regulation.

Study limitations include the lack of detailed clinical reports such as collision scenario, alcohol use, or helmet use. The actual incidence of e-scooter trauma may be underestimated because cases with unclear scooter type were excluded and some riders likely avoided the emergency department despite injury. Future research into pedestrian and cyclist trauma associated with e-scooter use is needed. Creating separate coding for standing and seated scooters may help avoid misclassification of assisted-living scooters with e-scooters.

Nearly one-third of patients had a head injury, more than double the rate of head injuries experienced by bicyclists.[5] A 2019 study found 4.8% of injured e-scooter riders wore a helmet,[4] while a multi-institutional case series reported only 2% used helmets.[2] Previous research has demonstrated helmet use is associated with lower risk of head injury.[6] E-scooter companies should facilitate and encourage helmet use by increasing helmet access.

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Concept and design: Namiri, Cohen, Breyer.
Acquisition, analysis, or interpretation of data: Namiri, Lui, Tangney, Allen, Cohen.
Drafting of the manuscript: Namiri, Lui, Allen, Cohen.
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